

Follow-up of Recommendations  
Resulting from System Safety Analysis

by

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ABSTRACT

System safety analyses often specify a corrective action to mitigate or eliminate potential hazards and comply with applicable safety requirements. Often the recommended action(s) cannot be taken immediately due to lack of funding, scheduling problems, etc. One way of tracking a large number of recommendations to ensure a satisfactory disposition is to use a computerized data base that includes all pertinent information. A tracking system program was developed to facilitate identification of recommendations by process, equipment, building, etc. Files are maintained on a daily basis. New recommendations are entered as safety analyses reports are finalized.

The status of older recommendations is updated as their disposition progresses. Validation of recommendation dispositions is done to assure that suitable corrective action(s) has been taken to reduce or eliminate the potential hazard and that the action has not introduced any new hazard into the operation.

INTRODUCTION

Recommendations resulting from system safety analyses per DARCOM-R 385-3 are tracked as required by MIL STD 882B. Tracking recommendations from system safety analyses of facilities, equipment and processes at the Radford Army Ammunition Plant is complicated by the sheer size and versatility of the plant. As shown in Figure 1, there are eight major production areas that use either basic raw ingredients or intermediate materials to manufacture primary items that are used to produce propellant or explosive products (Figure 2). As shown in Figure 3 many operations are required to produce the final products. Many of these operations are conducted in individual buildings spaced to limit damage/injury if an accident would occur. The literally hundreds of recommendations resulting from system safety investigations of these diverse operations and products were tracked initially using a labor intense manual operation. This system often "forgot" some long term recommendations and these were not implemented. Some recommendations were implemented in such a way as to introduce a new hazard(s). A computerized system was devised to track and account for all hazards analysis system safety recommendations on a regular (quarterly) basis. The system also includes a follow up review of the implemented recommendations by the recommendation initiator to assure that new hazards are not introduced.

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DISCUSSION

A computerized recommendation recall program was structured so that it would be manageable and allow tracking of the recommendation's status. The program contains all details relevant to the recommendation and shows which department is responsible for implementation.

Considerable effort went into developing the program because of the diverse plant operations. The program was structured using the dBase III format and as shown in Table 1, only the required information to track the recommendation is included. The information presented allows tracking of each recommendation by the Safety Department Coordinator (SDC), the responsible department and verification by the Hazards Analysis Department.

As shown in Table 1, tracking of recommendations in the diverse plant operations has been reduced to a manageable system.<sup>1</sup> This allows each plant area to quickly find the status of recommendations relating to them and provides the Safety Department with a way to track the recommendations. It also provides necessary information pertaining to the basic hazards assessment and provides management information on how timely implementation is proceeding by dividing the table into two sections: the first section is for the current quarter and section two is for previous quarters. An example of the information in the tracking system is shown in Table 1. A peristaltic valve in a blender located in the Finishing Area was assessed by Mr. C. A. Ferguson in Hazards Analysis Report HI-90-S-040(FW). Only one out of four recommendations was implemented when the quarterly status report was published. In the Recommendation Column, the letter and number in brackets, e.g., (B.1) is the identity of the recommendation in the reference hazards analysis report. By referring to sections 1 and 2 of the table, Management can determine the effectiveness of their departments in timely implementation of the system safety recommendations.

Hazard Track and Risk Resolution Task 105 in MIL STD 882B<sup>2</sup> specifies the need to track recommendations. Therefore, a recommendation tracking system must be closed loop. This is accomplished by requiring the responsible department to inform the SDC in writing when implementation of a recommendation(s) has been completed.

An example of the recommendation implementation process follows. First the recommendations (Table 2) being made are presented in writing to the department responsible for their implementation. Then the recommendations are entered in the data base file. The responsible department evaluates the recommendations and notifies the SDC of what action has been taken (Figure 5). The Hazards Analysis Department evaluates the action taken by the responsible area and notifies the SDC (Figure 6). Entry is made in the data base file that Recommendation 1 has been satisfied by inserting the word "Implemented" in the Status Column. Subsequent paperwork (Figure 7) informs the SDC of action pertaining to Recommendation 2. Hazards Analysis evaluates the responsible areas response and notifies (Figure 8) the SDC. All recommendations have now been implemented; therefore, as shown in Figure 8, the report file is closed. The data base is updated to show that Recommendation 2 has been implemented. A quarterly report is issued to Management for their review. The recommendation recall system is summarized in Figure 1.

CONCLUSIONS

Recommendations resulting from system safety analyses as required by DARCOM-R 385-3<sup>3</sup> can be tracked as required by MIL STD 882B by using a computerized data base. The program allows for tracking individual recommendations for all major production areas until implemented. After implementation they are automatically dropped from the Recommendation Recall Program.

## REFERENCES

- <sup>1</sup>Hazards Analysis Department Recommendation Recall Program, Hercules Aerospace Company, Hercules Incorporated, Radford AAP, Radford, VA.
- <sup>2</sup>MIL STD 882B, "System Safety Program Requirements".
- <sup>3</sup>DARCOM-R 385-3, "Hazards Analyses For Facilities, Equipment and Process Developments".

Status of Field Engineering Recommendations  
Through June 30, 1990

<u>Area, Operation and Equipment</u>	<u>Report Number</u>	<u>Recommendation</u>	<u>M or S*</u>	<u>Assigned To</u>	<u>Status of of 6-30-90</u>
1. Field Engineering Activity (This Qtr)					
A. Finishing					
1. Blending					
a. Valve,	HI-90-S-040(FW)	1. (B.1) -----	M	Production	Open
Peristaltic	05-31-90	2. (A.3) -----	M	Production	Open
	C. A. Ferguson	3. (A.2) -----	M	Production	Implemented
		4. (C.1) -----	S	Hazards Analysis	Open

(All Recommendations This Quarter Are Listed)

Recommendation Recall Program Modified Summary  
Table 1

1013

## Status of Field Engineering Recommendations (cont)

Area, Operation and Equipment	Report Number	Recommendation	M or S*	Assigned To	Status of of 6-30-90
2. Field Engineering					
Activity (Previous Qtrs)					
A. Finishing					
1. Material Handling					
a. Monorail System Building 1827	HI-89-S-012(FW) 02-06-1989 E. D. Burnett	1. (A.1)-----	M	Production, Maintenance	Open

(All Uncompleted Recommendations Are Listed)

\*  
M = Mandatory, S = Suggested

HI-90-S-019(FW)

Recommendations to Increase NC Wringer Operation Safety

<u>Recommendation</u>	<u>Safety Benefit</u>	<u>M or S*</u>	<u>Authority</u>	<u>Assigned To</u>	<u>Status</u>
Equipment					
1. Change the control box cooling air intake/exhaust for #3 and #4 wringers at Building 4026.	Reduce/eliminate #3 wringer kickout during hot weather	M	Standard Safety Practice	Engineering	Open

SYSTEM SAFETY ANALYSES RECOMMENDATIONS

Table 2



HI-90-S-019(FW)

Recommendations to Increase NC Wringer Operation Safety (cont)

1016

<u>Recommendation</u>	<u>Safety Benefit</u>	<u>M or S*</u>	<u>Authority</u>	<u>Assigned To</u>	<u>Status</u>
Procedure					
1. Discuss processing of "thick" NC slurry during safety meetings	Reduce/eliminate wringer problems caused by an unbalanced load	M	Standard Safety Practice	Production	Open

\*M=Mandatory, S=Suggested

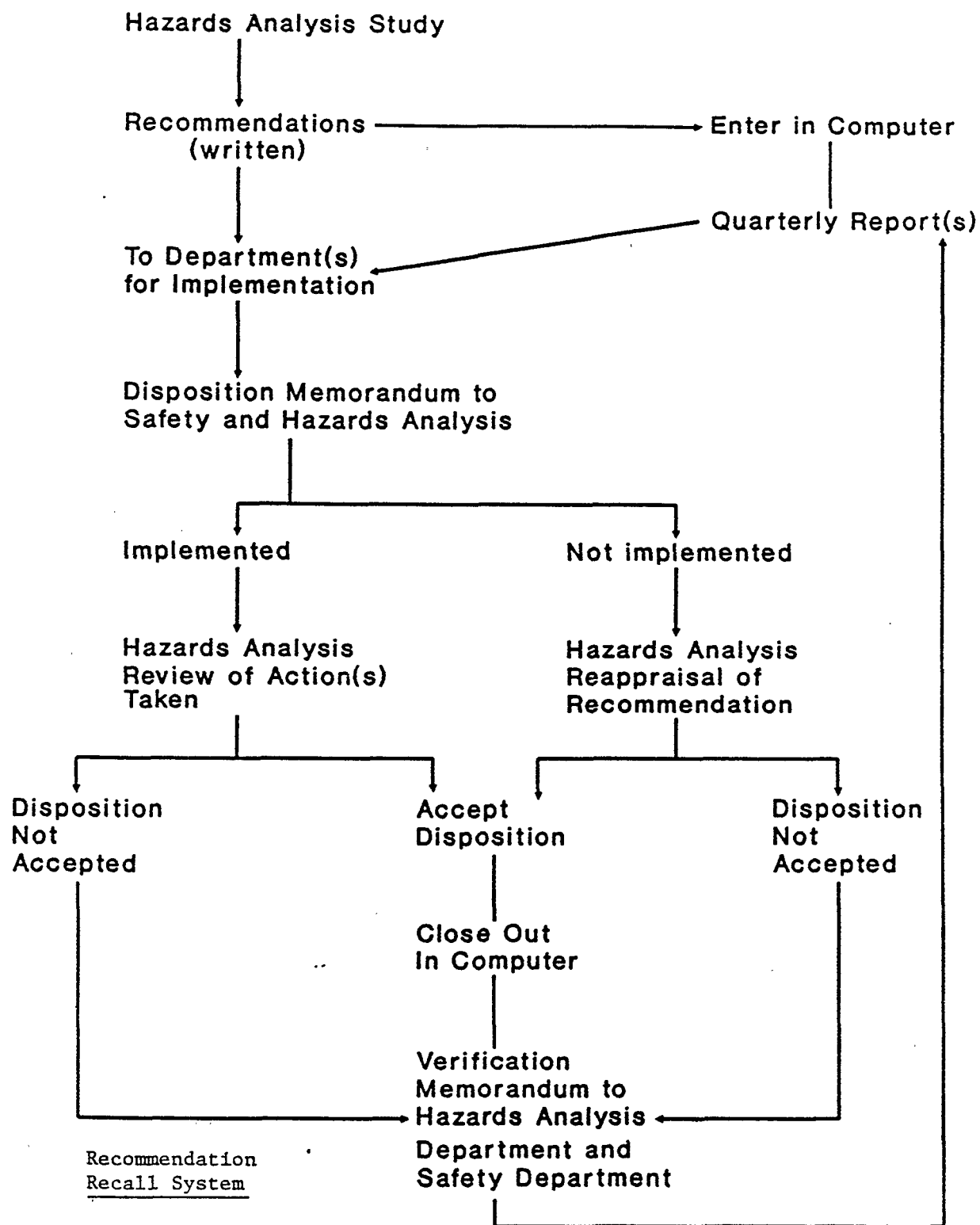
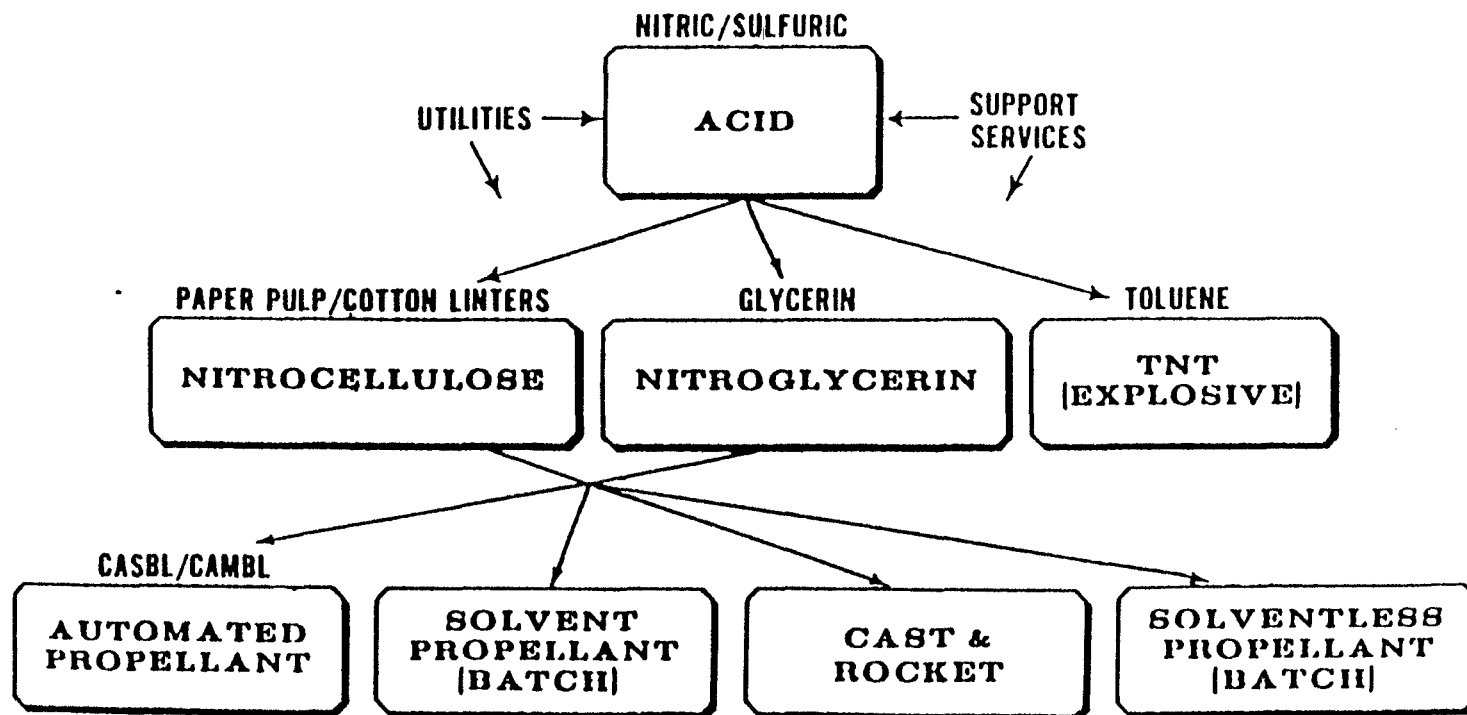


Figure 1  
1017



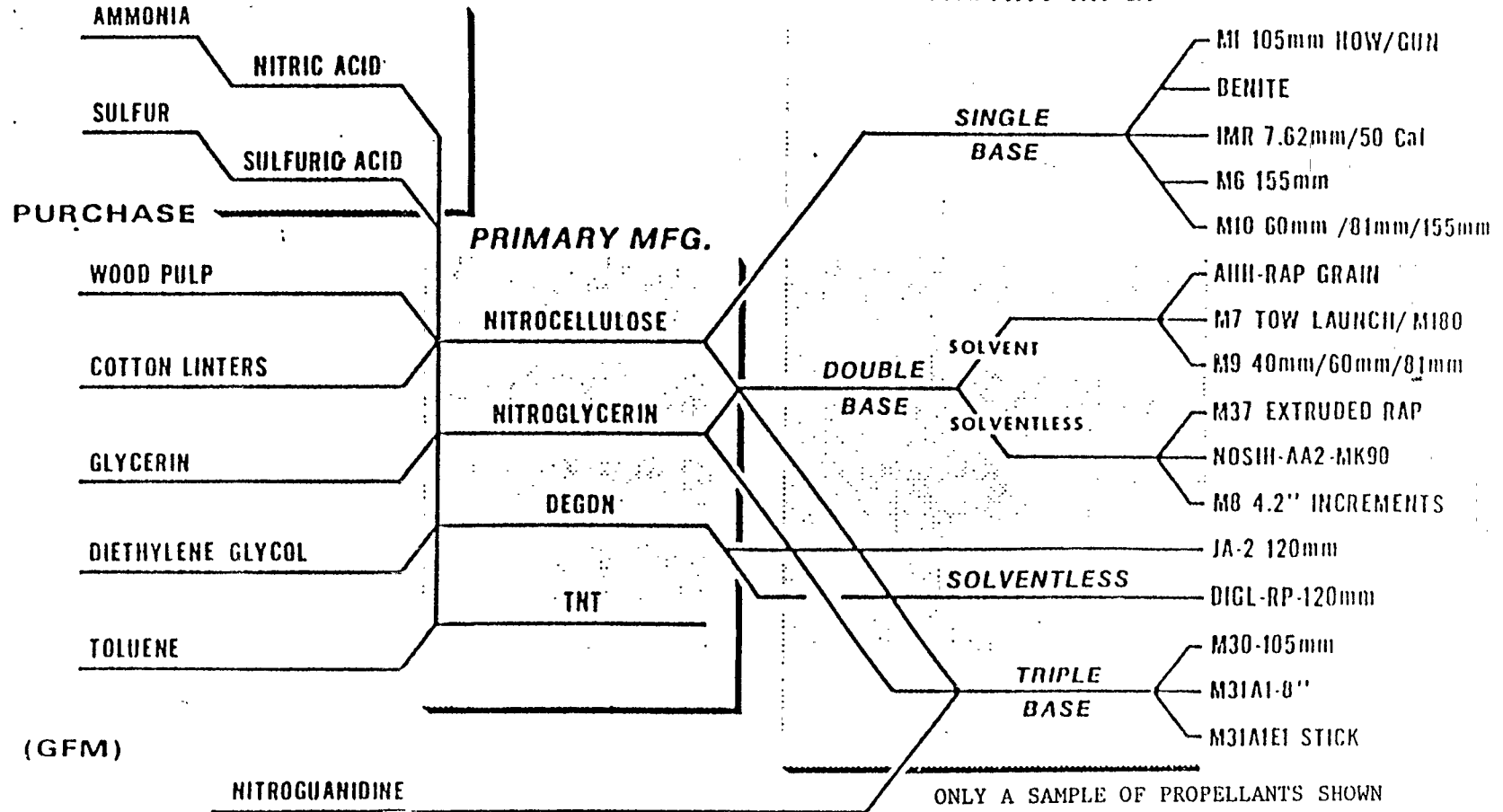
RAAP MAJOR PRODUCTION AREAS

FIGURE 2

RAW  
MATERIALS

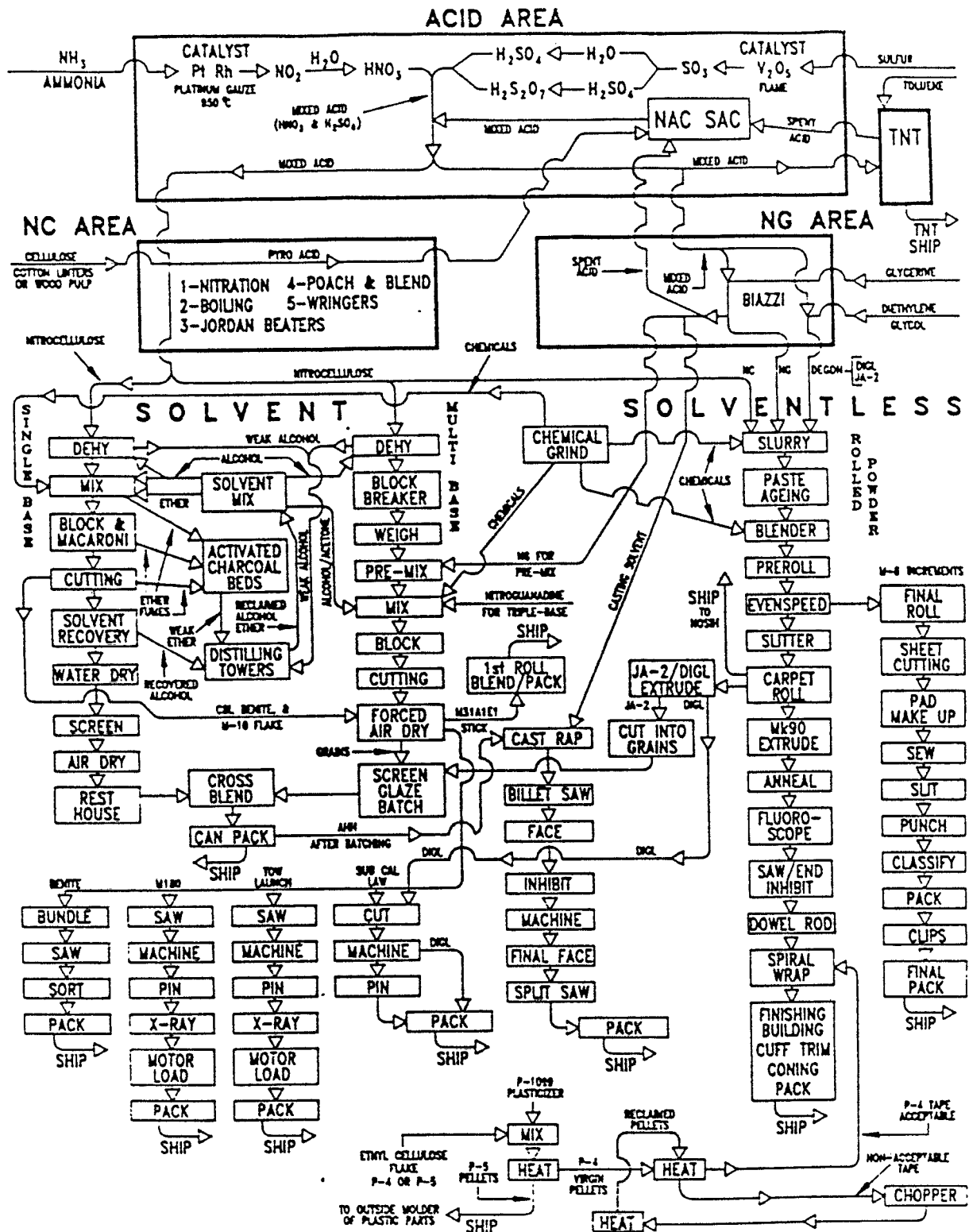
BASIC MFG.

SECONDARY MFG.



BASE MATERIALS FLOW DIAGRAM  
FOR PROPELLANTS MANUFACTURED AT RAAP

FIGURE 3





RADFORD ARMY AMMUNITION PLANT

*Safety is part of your job.*

April 30, 1990

## Memorandum

c: Dept. Managers

TO: Safety Department Coordinator

FROM: \_\_\_\_\_  
NC Purification Area SupervisorSUBJECT: Recommendation #1, Hazard Analysis Field Engineering Survey  
#HI-90-S-019FW

Safety meetings were conducted with all personnel on the importance of processing a thick slurry with which to load the wringers. This will assist in keeping a wringer from wobbling. Even then, loading #3 wringer in 4026 with extreme caution, it still had a tendency to wobble. Therefore, maintenance was requested to disassemble the transmission to check it. A buffer in the transmission was found to be worn. It was replaced and reassembled. This eliminated the wobbling problem on #3 wringer. This bad buffer was instrumental in the incident on March 5.

AREA RESPONSE TO RECOMMENDATIONS

JRF/mlw

FIGURE 5



RADFORD ARMY AMMUNITION PLANT

*Safety is part of your job.*

July 9, 1990

**Memorandum**

c: Dept. Managers

TO: Safety Department Coordinator

FROM: \_\_\_\_\_  
Hazard Analysis EngineerEvaluation of Response(s) to Hazard Study RecommendationsReference Report: HI-90-S-019(FW), Equipment Damage.Plant Area/Operation: Chemical Process/NC, Building 4026.Evaluation Method: Review of response from NC Area Supervision to SDC dated April 30, 1990.

Results: Recommendation #1 has been satisfied. Processing of thick NC slurry was discussed with all wringer house personnel at safety meetings. In addition, disassembly of the transmission on wringer #3 revealed a worn buffer which contributed to the wobble problem. The worn buffer was replaced.

Recommendation #2 remains open. NC Area is requested to advise the SDC when recommendation #2 is completed.

Hazard Analysis Supervisor

Evaluation of Response(s) to Hazard Study Recommendations

Figure 6



RADFORD ARMY AMMUNITION PLANT

*Safety is part of your job.*

## Memorandum

July 12, 1990

c: Dept. Managers

TO: Safety Department Coordinator

FROM: \_\_\_\_\_  
NC Department Supervision

SUBJECT: Hazards Analysis Field Engineering Survey HI-90-S-019(FW)

The subject survey had two recommendations. As per my memo of April 30, 1990, Recommendation #1 has been satisfied.

Since June 11, 1990 the #4 wringer control box exhaust has been relocated to prevent it from entering the #3 wringer control box air intake. This satisfies recommendation #2.

JRF/mlw

Area Response to Recommendations  
Figure 7





RADFORD ARMY AMMUNITION PLANT

*Safety is part of your job.*

## Memorandum

July 17, 1990

c: Dept. Managers

TO: Safety Department Coordinator

FROM: \_\_\_\_\_  
Hazard Analysis EngineerEvaluation of Response(s) to Hazard Study RecommendationsReference Report: HI-90-S-019(FW), Equipment Damage.Plant Area/Operation: Chemical Process/Nitrocellulose, Building 4026.Evaluation Method: Review of memo from NC Area Supervision to SDC dated July 12, 1990.Results: All recommendations have been implemented. This report is closed.\_\_\_\_\_  
Hazard Analysis SupervisorEvaluation of Response(s) to Hazard Study Recommendations  
Figure 8